

Encyclopedia of Polymer Science and Technology, Version 3
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688 POLYMERS FROM RENEWABLE SOURCES

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Table 2. Applications of Starch Derivatives^a

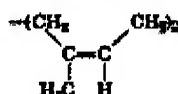
| Starch or derivative | Applications | Refs. |
|--|---|----------|
| glycol glucosides | urethane foams, surfactants, alkylid resins | 42-46 |
| combination with poly(ethylene-co-acrylic acid) and polyethylene | biodegradable materials as mulch film | 47 |
| carboxymethylstarch | water-soluble laundry-detergent bags | 48 |
| starch emulsions of rubber | assist in rubber manufacture | 49 |
| droplets, powdered rubber in latex | | |
| insoluble starch xanthates | removal of heavy metal contaminants from industrial process water | 50 |
| graft starch products ^b | absorption of body fluids; thickening agents; fire control; removal of water in fuel-alcohol mixtures | 35,51,52 |

^a Ref. 4.^b Including Super Sturper.

Rubber and Gutta Percha

Natural rubber has been used for a long time. Columbus noticed that the natives of Haiti played with balls prepared from the gum of a local tree (53). Rubber is present in the *Hevea* tree (*Hevea brasiliensis*) as a natural latex or in submicroscopic dispersion in a saplike material. These latices appear milk-white. The first commercial rubber was obtained from trees in Brazil (see RUBBER, NATURAL).

Natural rubber consists of poly(*cis*-1,4-isoprene).



The *cis* isomer is usually an amorphous solid with a T_g of -72°C ; it melts at 27°C if crystallized. The *trans* isomer, known as gutta percha or balata, is a highly crystalline polymer; sources are given in Table 9. The most important sources are the plantations in Malaysia and Indonesia.

Production. The commercial growth of natural rubber developed rapidly with the invention of the pneumatic tire. Beginning with World War II, the

Table 9. Sources of Rubber

| Common name | Botanical name | Region |
|--|------------------------------|------------------|
| Poly(<i>cis</i>-1,4-isoprene) | | |
| natural rubber | <i>Hevea brasiliensis</i> | Brazil, Malaysia |
| gumyule | <i>Parthenium argentatum</i> | Mexico, Texas |
| dandelion | <i>Taraxacum</i> | USSR |
| Poly(<i>trans</i>-1,4-isoprene) | | |
| gutta percha | <i>Palaquium gutta</i> | Malaysia |
| | <i>Diospyros gutta</i> | |
| balata | <i>Bolit tree</i> | Brazil |